Ateliers Tikz-LaTeX
Congrès SBPMef

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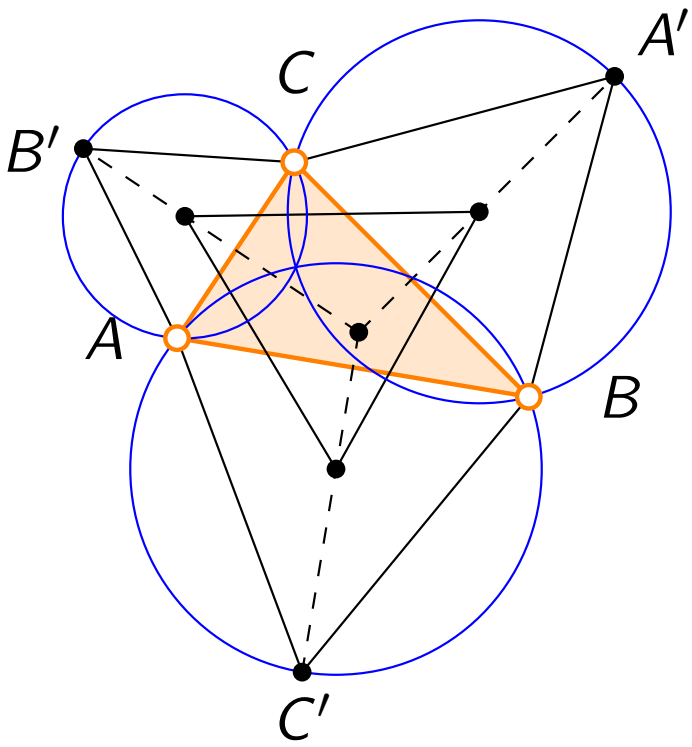
http://dev.ulb.ac.be/urem



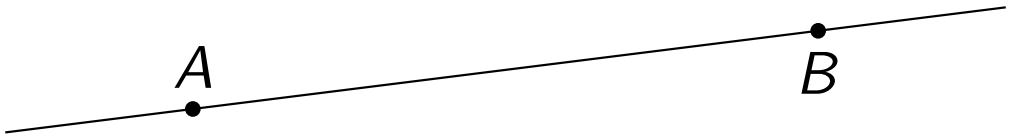
Problèmes et exercices

H. Vermeiren
&
Yves Delhaye

Tracé d'une droite

H. Vermeiren
&
Yves Delhaye

Les points A et B sont donnés.
Représenter la droite (AB) comme ci-dessous.



Aide :

```
\coordinate (X) at ($(A)!k!(B)$);
```

construit le point X tel que $\overrightarrow{AX} = k\,\overrightarrow{AB}$

Solution 1

Une macro pour tracer des droites

H. Vermeiren
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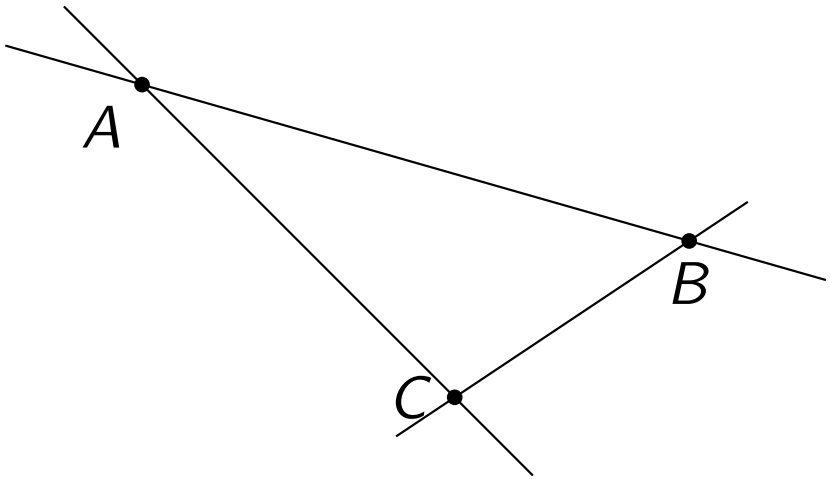
Yves Delhaye

Construire une **macro** traçant la droite (XY).
Le tracé *dépassera* le segment $[AB]$ de 20% de AB.

A l'aide ce cette macro, tracer les droites par A, B et C.



Solution 2

Rappel : Syntaxe d'une macro LaTeX

```
\newcommand{Nom_macro}[nb_args]{
    ... code ...
    }
```

Dans le code, les arguments sont désignés, dans l'ordre, par #1,#2,...

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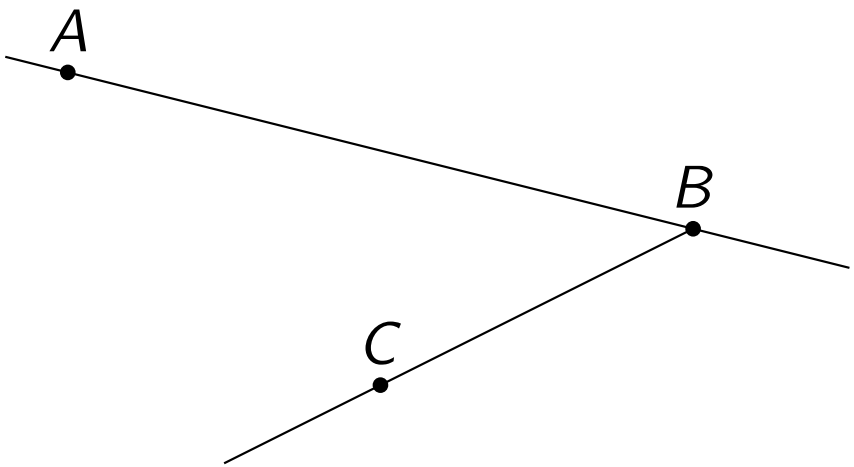
Quelques petits réglages...

Modifier la macro crée précédemment pour que *le tracé* de la droite (XY) dépasse

- de i% de XY du côté de X,
- de j% de XY du côté de Y.

Comment peut-on alors tracer des demi-droites?



Solution 3

Intersection de droites

H. Vermeiren
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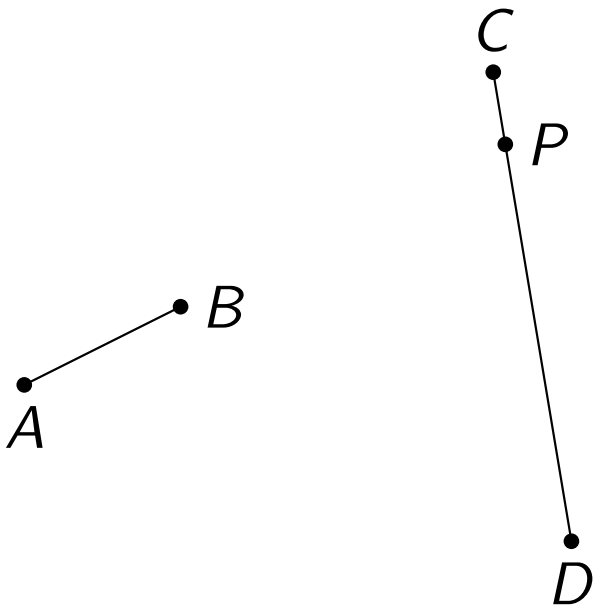
Yves Delhaye

L'instruction `\coordinate (X) at (intersection of A--B and C--D);`
construit le point X à l'intersection des droites (AB) et (CD).

Vérifier ce fait en reproduisant la figure suivante.



Que se passe-t-il si les droites sont parallèles?

Solution 4

Le Théorème de *Céva*

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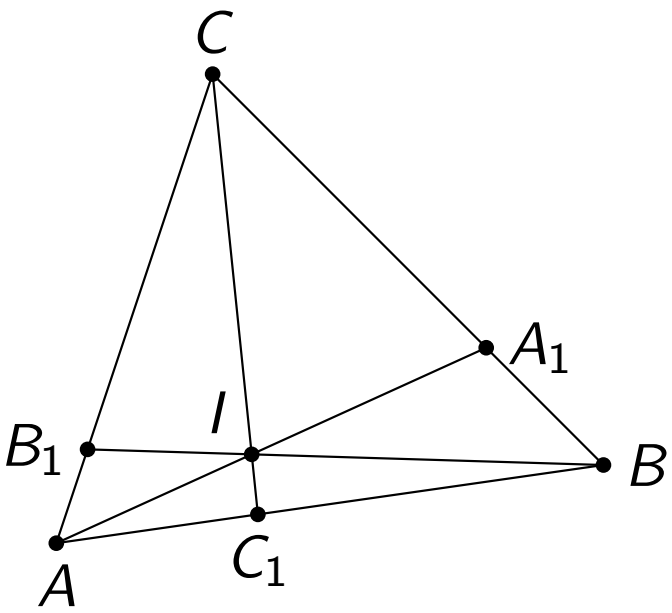
Recréer la figure suivante



$$\frac{AC_1}{C_1B} \cdot \frac{BA_1}{A_1C} \cdot \frac{CB_1}{B_1A} = 1$$

Solution 5

Le 4ème point d'un parallélogramme

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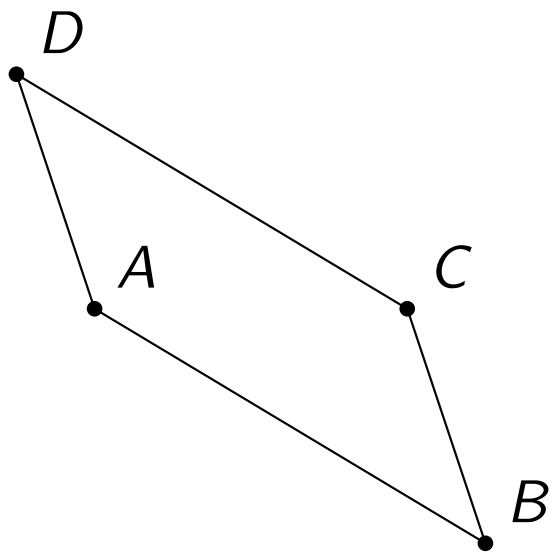
On peut réaliser des calculs *complexes* sur les coordonnées/composantes!
Quelque chose comme `($(A) +/- (B) +/- (C)... $)`

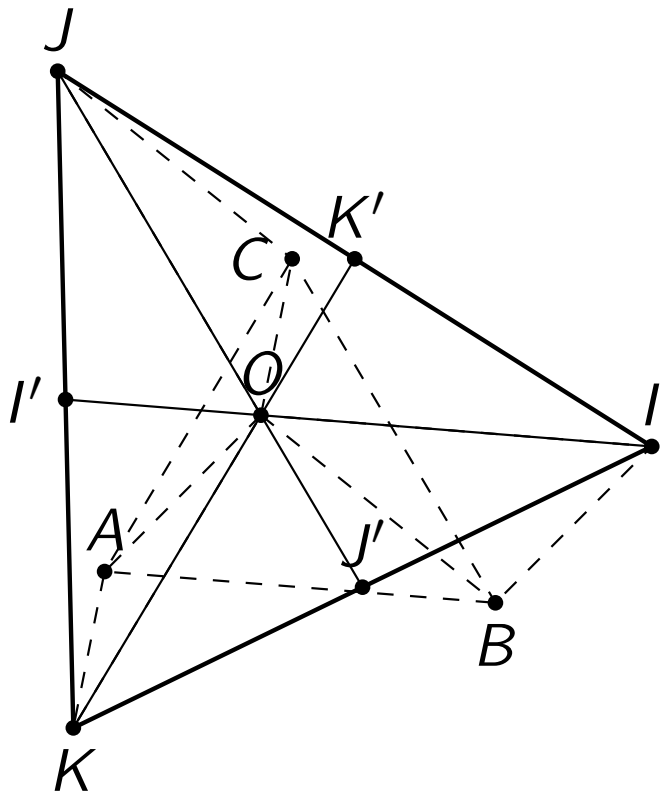
Application: On donne les points A, B et C. Construire D tel que $ABCD$ soit un parallélogramme.



Solution 6

Triangles, parallélogrammes et barycentre

Le point O est intérieur au triangle ABC.
I,J et K sont tels que OABI, OBCJ et OCAK sont des parallèlogrammes.
Montrer que O est le barycentre du triangle IJK.



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Solution 7

Sommes vectorielles

H. Vermeiren
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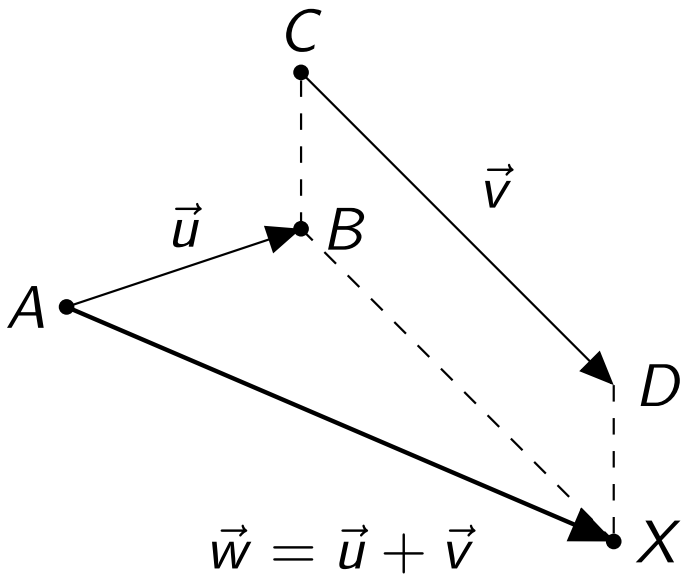
Yves Delhaye

Construire le point X tel que $\overrightarrow{AX} = \overrightarrow{AB} + \overrightarrow{CD}$



Solution 8

La parallèle par un point

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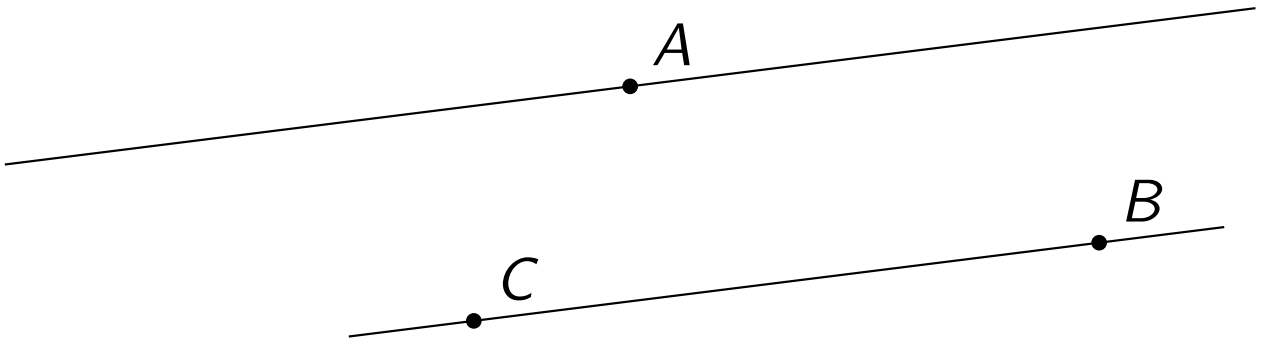
Yves Delhaye

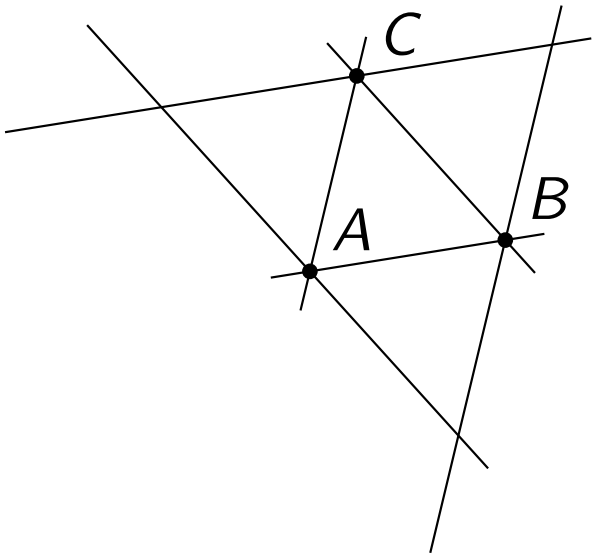
Construire la parallèle à (BC) passant par A.



Solution 9

La macro “parallèle”

Rédiger une macro qui permet de tracer des parallèles *à la volée*...



La macro permet-elle de construire facilement les points d'intersection de ces parallèles

Solution 10

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Un exercice classique

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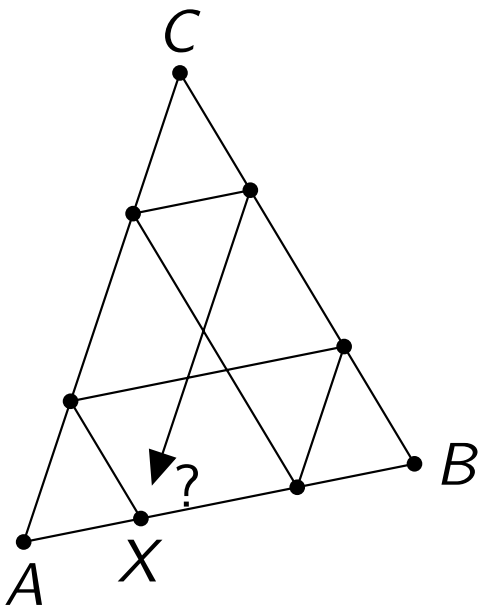
Yves Delhaye

Le chemin partant de X arrive-t-il bien en X?



Solution 11

Construction de $\sqrt{a}$

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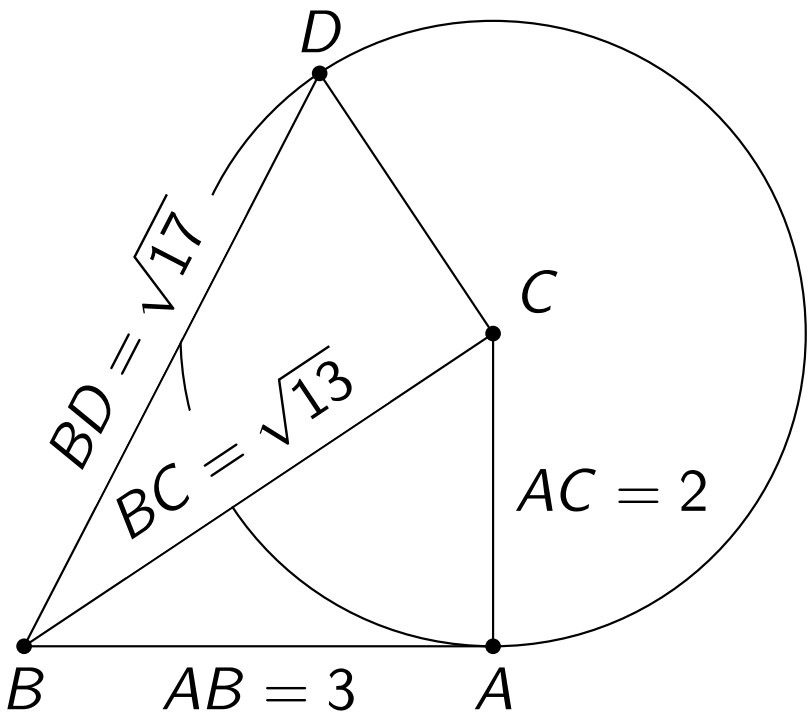
Yves Delhaye

Construire le réel $\sqrt{17}$ à l'aide de triangles rectangles.

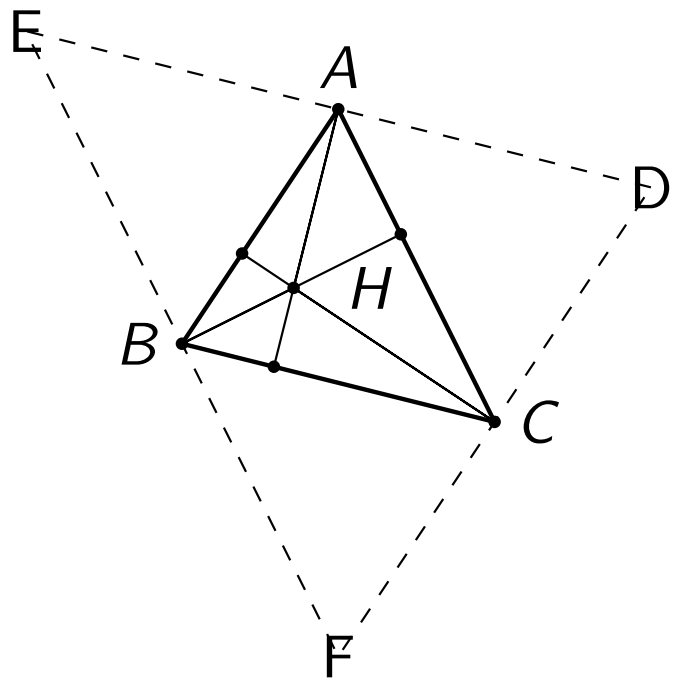


Solution 12

Hauteurs d'un triangle

Construire les hauteurs et l'orthocentre d'un triangle ABC.

On s'aidera du triangle dont A,B et C sont les milieux des côtés.



La figure est-elle encore présentable lorsque H est extérieur au triangle?

Solution 13

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&
Yves Delhaye

Solutions

Tracé d'une droite

```
\begin{tikzpicture}
  \coordinate (A) at (-2,0);
  \coordinate (B) at (2,0.5);
  \coordinate (A') at ($(A)!-0.3!(B)$);
  \coordinate (B') at ($(A)!1.3!(B)$);
  \draw (A')--(B');
  \fill (A) circle (0.5mm) node[above]{$A$};
  \fill (B) circle (0.5mm) node[below]{$B$};
\end{tikzpicture}
```

Retour énoncé 1

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Yves Delhaye

Une macro pour tracer des droites

H. Vermeiren
&
Yves Delhaye

```
\newcommand{\SmartLine}[2]{
  \coordinate (ATemp) at ($(#1)!-0.2!(#2)$);
  \coordinate (BTemp) at ($(#1)!1.2!(#2)$);
  \draw (ATemp)--(BTemp);
  }

\begin{tikzpicture}
  \coordinate[label=below left:$A$] (A) at (-2,1);
  \coordinate[label=below:$B$] (B) at (1.5,0);
  \coordinate[label=left:$C$] (C) at (0,-1);
  \SmartLine{A}{B}
  \SmartLine{B}{C}
  \SmartLine{C}{A}
  \foreach \p in {A,B,C}
    \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 2

Quelques petits réglages...

```
\newcommand{\CleverLine}[4]{
  \coordinate (ATemp) at ($(#1)!{-#3}!(#2)$);
  \coordinate (BTemp) at ($(#1)!{1+#4}!(#2)$);
  \draw (ATemp)--(BTemp);
  }

\begin{tikzpicture}
  \coordinate (A) at (-2,1);
  \coordinate (B) at (2,0);
  \coordinate (C) at (0,-1);
  \CleverLine{A}{B}{0.1}{0.25}
  \CleverLine{B}{C}{0}{0.5}
  \foreach \p in {A,B,C}
  \fill (\p) circle (0.5mm) node [above]{$\p$};
\end{tikzpicture}
```

Retour énoncé 3

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&
Yves Delhaye

Intersection de deux droites

```
\begin{tikzpicture}
  \coordinate[label=below:$A$] (A) at (-1,0);
  \coordinate[label=right:$B$] (B) at (0,0.5);
  \coordinate[label=above:$C$] (C) at (2,2);
  \coordinate[label=below:$D$] (D) at (2.5,-1);
  \coordinate[label=right:$P$]
      (P) at (intersection of A--B and C--D);
  \draw (A)--(B) (C)--(D);
  \foreach \p in {A,B,C,D,P} \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 4

H. Vermeiren
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Yves Delhaye

Le Théorème de *Céva*

H. Vermeiren
&
Yves Delhaye

```
\begin{tikzpicture}
  \coordinate[label=below:$A$] (A) at (-1,0);
  \coordinate[label=right:$B$] (B) at (2.5,0.5);
  \coordinate[label=above:$C$] (C) at (0,3);
  \coordinate[label=right:$A_1$] (A1) at ($(B)!0.3!(C)$);
  \coordinate[label=left:$B_1$] (B1) at ($(C)!0.8!(A)$);
  \coordinate[label=above left:$I$]
    (I) at (intersection of A--A1 and B--B1);
  \coordinate[label=below:$C_1$]
    (C1) at (intersection of C--I and A--B);
  \draw (A)--(B)--(C)--cycle;
  \draw (A)--(A1) (B)--(B1) (C)--(C1);
  \foreach \p in {A,B,C,A1,B1,C1,I}
    \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 5

Le 4ème point d'un parallélogramme

```
\begin{tikzpicture}
  \coordinate (A) at (-1,1);
  \coordinate (B) at (1.5,-0.5);
  \coordinate (C) at (1,1);
  \coordinate (D) at ($(A)+(C)-(B)$);
  \draw (A)--(B)--(C)--(D)--cycle;
  \foreach \p in {A,B,C,D}
  \fill (\p) circle (0.5mm) node [above right]{$\p$};
\end{tikzpicture}
```

Retour énoncé 6

H. Vermeiren
&
Yves Delhaye

Une figure plus complexe

```
\begin{tikzpicture}
  \coordinate[label=above:$A$] (A) at (-1,-1);
  \coordinate[label=below:$B$] (B) at (1.5,-1.2);
  \coordinate[label=left:$C$] (C) at (0.2,1);
  \coordinate[label=above:$O$] (O) at (0,0);
  \coordinate[label=above:$I$] (I) at ($(B)+(O)-(A)$);
  \coordinate[label=above:$J$] (J) at ($(C)+(O)-(B)$);
  \coordinate[label=below:$K$] (K) at ($(A)+(O)-(C)$);
  \coordinate[label=above:$K'$] (K') at ($(I)!0.5!(J)$);
  \coordinate[label=left:$I'$] (I') at ($(J)!0.5!(K)$);
  \coordinate[label=above:$J'$] (J') at ($(K)!0.5!(I)$);
  \draw[dashed] (O)--(A)--(B)--(I)--cycle;
  \draw[dashed] (O)--(B)--(C)--(J)--cycle;
  \draw[dashed] (O)--(C)--(A)--(K)--cycle;
  \draw (I)--(I') (J)--(J') (K)--(K');
  \draw[thick] (I)--(J)--(K)--cycle;
  \foreach \p in {A,B,C,I,J,K,O,I',J',K'}
  \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 7

H. Vermeiren
&
Yves Delhaye

Sommes vectorielles

H. Vermeiren
&
Yves Delhaye

```
\begin{tikzpicture}
   \coordinate[label=left:$A$] (A) at (-1,0.5);
   \coordinate[label=right:$B$]  (B) at (0.5,1);
   \coordinate[label=above:$C$]  (C) at (0.5,2);
   \coordinate[label=right:$D$]  (D) at (2.5,0);
   \coordinate[label=right:$X$]  (X) at ($(B)+(D)-(C)$);
   \draw[->,>=triangle 45] (A)--(B)
      node[midway,above]{$\vec{u}$};
  \draw[->,>=triangle 45] (C)--(D)
      node[midway,above right]{$\vec{v}$};
  \draw[->,>=triangle 45,thick] (A)--(X)
      node[midway,below=0.5cm]
      {$\vec{w}=\vec{u}+\vec{v}$};
  \draw[dashed] (B)--(X) (B)--(C) (D)--(X);
  \foreach \p in {A,B,C,X} \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 8

La parallèle par un point

```
\begin{tikzpicture}
  \coordinate (A) at (-2,1);
  \coordinate (B) at (1,0);
  \coordinate (C) at (-3,-0.5);
  \coordinate (TempA) at ($(A)+(B)-(C)$);
  \coordinate (TempB) at ($(A)-(B)+(C)$);
  \draw (TempA)--(TempB);
  \CleverLine{B}{C}{.2}{.2}
  \foreach \p in {A,B,C}
  \fill (\p) circle (0.5mm) node [above right]{$\p$};
\end{tikzpicture}
```

Retour énoncé 9

H. Vermeiren
&
Yves Delhaye

La parallèle par un point

```
\newcommand{\parallele}[5]{
  \coordinate (ATemp) at ($(#1)+(#3)-(#2)$);
  \coordinate (BTemp) at ($(#1)!{-#4}!(ATemp)$);
  \coordinate (CTemp) at ($(#1)!{1+#5}!(ATemp)$);
  \draw (BTemp)--(CTemp);
  }

\begin{tikzpicture}
  \coordinate (A) at (-.5,-.5);
  \coordinate (B) at (.75,-.3);
  \coordinate (C) at (-.2,.75);
  \foreach \p / \q in {A/B,B/C,C/A}
  \CleverLine{\p}{\q}{.2}{.2};
  \parallele{A}{B}{C}{1.2}{.5}
  \parallele{B}{C}{A}{1.2}{0.6}
  \parallele{C}{B}{A}{1.2}{0.8}
  \foreach \p in {A,B,C}
  \fill (\p) circle (0.5mm) node [above right]{$\p$};
\end{tikzpicture}
```

Retour énoncé 10

H. Vermeiren
&
Yves Delhaye

Un exercice classique

```
\begin{tikzpicture}
  \def\r{0.3}
  \coordinate[label=below:$A$] (A) at (-1,-1);
  \coordinate[label=right:$B$] (B) at (1.5,-0.5);
  \coordinate[label=above:$C$] (C) at (0,2);
  \coordinate[label=below:$X$] (X1) at ($(A)!\r!(B)$);
  \coordinate (X2) at ($(A)!\r!(C)$);
  \coordinate (X3) at ($(B)!\r!(C)$);
  \coordinate (X4) at ($(B)!\r!(A)$);
  \coordinate (X5) at ($(C)!\r!(A)$);
  \coordinate (X6) at ($(C)!\r!(B)$);
  \coordinate (P) at ($(X6)!0.9!(X1)$);
  \draw (A)--(B)--(C)--cycle;
  \draw[->,>=triangle 45]
    (X1)--(X2)--(X3)--(X4)--(X5)--(X6)--(P)
    node[right]{?};
  \foreach \p in {A,B,C,X1,X2,X3,X4,X5,X6}
  \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 11

H. Vermeiren
&
Yves Delhaye

Construction de $\sqrt{a}$

H. Vermeiren
&
Yves Delhaye

```
\begin{tikzpicture}
  \coordinate[label=below:$B$] (B) at (-1,0);
  \coordinate[label=below:$A$] (A) at (2,0);
  \coordinate[label=above right:$C$]
        (C) at ($(A)!{2/3}!-90:(B)$);
  \coordinate[label=above:$D$]
        (D) at ($(C)!{2/sqrt(13)}!-90:(B)$);
  \draw (C) circle (2cm);
  \draw (A)--node[midway,below]{$AB=3$}
        (B)--node[midway,sloped,above,fill=white]
     {$BC=\sqrt{13}$}
        (C)--node[midway,right]{$AC=2$} (A);
  \draw (C)--(D)--node[midway,sloped,above,fill=white]
        {$BD=\sqrt{17\,}$}(B);
  \foreach \p in {A,B,C,D}
    \fill (\p) circle (0.5mm);
\end{tikzpicture}
```

Retour énoncé 12

Hauteurs et orthocentre d'un triangle

H. Vermeiren
&
Yves Delhaye

```
\begin{tikzpicture}[scale=0.5]
  \coordinate[label=above:$A$] (A) at (0,3);
  \coordinate[label=left:$B$] (B) at (-2, 0);
  \coordinate[label=right:$C$] (C) at (2,-1);
  \coordinate (D) at ($(A)+(C)-(B)$);
  \coordinate (E) at ($(B)+(A)-(C)$);
  \coordinate (F) at ($(C)+(B)-(A)$);
  \draw[thick] (A)--(B)--(C)--cycle;
  \coordinate (HA) at ($(A)!1.5!-90:(D)$);
  \coordinate (HB) at ($(B)!1!-90:(E)$);
  \coordinate (HC) at ($(C)!1!-90:(F)$);
  \coordinate (H) at (intersection of HA--A and HB--B);
  \coordinate (A') at (intersection of HA--A and B--C);
  \coordinate (B') at (intersection of HB--B and C--A);
  \coordinate (C') at (intersection of HC--C and A--B);
  \draw (A)--(A') (A)--(H);
  \draw (B)--(B') (B)--(H);
  \draw (C)--(C') (C)--(H);
  \draw[dashed] (A)--(B') (B)--(A') (A)--(C');
  \foreach \i in {A,B,C,A',B',C'}
    \fill (\i) circle (0.8mm);
  \fill (H) circle (0.8mm) node[right=0.2cm]{$H$};
  \draw[dashed]
  (D) node{D}--(E) node {E}--(F) node{F}--cycle;
\end{tikzpicture}
```

Retour énoncé 13

Fin!